

# **Pest Management Grants—Demonstration Final Report**

**Project Title:** Promoting Urban-based Ecological Pest Management: Expanding Outreach in East Bay Schools and Community gardens.

**Agreement number:** #00-0201S

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University of California at Berkeley

**Contractors Name:** The Regents of the University of California

**Date:** June 7, 2002

*Prepared for the California  
Department of Pesticide Regulation*

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## **Acknowledgments**

Only this section should contain acknowledgments of key personnel and organizations, including name, address, appropriate telephone numbers, and e-mail address of those associated with the project. The last paragraph of the acknowledgments must read as follows:

This report was submitted in fulfillment of DPR #00-0201S, Promoting Urban-based Ecological Pest Management: Expanding Outreach in East Bay Schools and Community gardens, by The Regents of the University of California under the full sponsorship of the California Department of Pesticide Regulation. Work was completed as of May, 2002.

## **EXECUTIVE SUMMARY**

This project consisted of the continuation of phase three of a training, demonstration and outreach project on IPM in urban agriculture. Curricular activities at several public school gardens located in low-income neighborhoods of Berkeley and Oakland have for the past two years focused on ecologically-based pest management (EBPM). Students received in-class education as well as in-field training. Students set up experiments in school gardens as well as at UC Berkeley's Gill Tract, where they monitored crop-pest-natural enemy interactions, and provided EBPM outreach to their local community through after-school gardening teams and organized instructional field days. Outreach to community groups resulted in the establishment of two community gardens in low-income neighborhoods in Oakland, one of which was used by the adjacent middle school for pedagogic activities. The third phase of this project is designed to expand EBPM outreach activities through demonstration-participatory activities. Twenty two families each managed a 6x8 meter diversified garden plot, planted with the same set of six main crops, located at UC Berkeley's Gill Tract research facility. We presented 3 workshops to participating families and trained them in EBPM and soil fertility management.

Each family was instructed to record all treatments they applied to their garden plots and the yield of all their production. These observations and yields were used to identify which management practices were the most successful in preventing pest and disease damage, improving soil quality and maintaining high yields.

As each family has managed their plots differently, we expected significant differences in pest levels and yields. During our final workshop, families had the opportunity to discuss why certain garden designs and management techniques performed better than others. In addition to serving as a demonstration site, the results from the family plots provided scientific information relevant to improving EBPM in urban settings.

In addition to the community garden plots, two research and demonstration plots were established to test the effects of fertilizer and crop diversity on biological pest control. The results from the experimental plots were analyzed and showed the following general trends:

1. Pest damage was higher in chemically fertilized plots compared to organically fertilized ones.
2. Pest damage was lower in plots that were inter-cropped with flowering plants such as phacelia and buckwheat.

## **INTRODUCTION**

The main goal of this on-going two year project has been to establish gardens at various schools in low-income areas featuring vegetable cropping systems each producing salad vegetables and some staple crops, and to better integrate in-class science lessons with school gardens. About 60 students have participated in all aspects of garden development including the use of ecologically-based methods of agricultural management.

Established demonstration plots have served to promote outreach activities as the benefits from the school gardens have been extended to other schools, community gardens and the general public through field days and roving workshops, but mainly through direct involvement of trained school children as interns in community urban agriculture initiatives. In this way, urban agriculture has become an outgrowth from school initiatives led by well trained and motivated children. Pedagogic activities have taken place at four public schools in Alameda County: Columbus Elementary, Hoover Elementary, Willard Middle School and MacGregor Extension High School.

A key hypothesis of this program has been that established demonstration plots serve to promote outreach activities through direct involvement of trained school children as interns in community urban agriculture initiatives. To further this goal we involved 22 selected families in the management, monitoring and evaluation of experimental plots at University of California's Gill Tract research facility in Albany. After an initial training period each family was assigned a 6x8 meter plot (all plots had the same six main crops) which they tended and managed according to their level of knowledge and skills. By mutual interactions in the field, families have been able to exchange information, but also to assess why certain management EBPM techniques work better than others in terms of pest suppression and crop yields. Such plots were also open for teachers to bring their class to learn about ecology and also to the wider community through organized field days, with the potential to reach more than 300 people in one year.

Managed plots by the various families served as demonstration units showing differential levels of "gardening" success, but also given the variability in garden performance, they provide key scientific information relevant to improving EBPM approaches for urban settings.

### **Project Objectives**

- a. Continue our activities at the various schools aimed at integrating existing public school gardens with the science curriculum, incorporating ecologically-based pest management techniques to control insects, diseases and weeds affecting urban gardens.

- b. Establish a community garden where selected families will be able to conduct comparative research in plots at UC Berkeley's Gill Tract to test the effects of various agroecological practices on pest incidence (i.e. growing plants in mono or polycultures, fertilizing crops with chemical vs. organic fertilizers, etc.).
- c. Involve students in all practical aspects of garden development and allow students to conduct comparative research in pilot areas of the gardens to test the effects of various agroecological practices on pest incidence.
- d. To disseminate project achievements and results to other schools by bringing classes to the site, and to the wider community through outreach activities such as field days, workshops and cross-visits.

## **RESULTS & DISCUSSION**

- a. Continue our activities at the various schools aimed at integrating existing public school gardens with the science curriculum, incorporating ecologically-based pest management techniques to control insects, diseases and weeds affecting urban gardens.

Curricular activities were taught and students were involved in all aspects of school garden development, including design, planting, composting, weeding, etc.

- b. Establish a community garden where selected families will be able to conduct comparative research in plots at UC Berkeley's Gill Tract to test the effects of various agroecological practices on pest incidence (i.e. growing plants in mono or polycultures, fertilizing crops with chemical vs. organic fertilizers, etc.).

Twenty two families were each given a 6x8 meter prepared garden plot to manage using agroecological practices. Each family was supplied with seedlings and seeds for six main crops: tomato, basil, Swiss chard, string beans, broccoli and lettuce. Participants were trained on basic gardening skills and a variety of agroecological practices for soil management, and pest control. Each family was encouraged to adopt any practices they deemed appropriate. We provided fertilization and mulch materials and UC Staff were available for informal consultations throughout the duration of the project.

During early May, a large area at the Gill Tract was plowed to incorporate the winter cover crop and tilled to form long rows, 1 m on centers. At the end of May the field was divided into 22 small plots (50 m<sup>2</sup> each) crosswise to the rows. During a planting workshop, all families planted the seedlings and seeds of the six main crops: tomatoes, basil, Swiss chard, lettuce, broccoli and bush beans. The families were given another workshop on ecological gardening methods and then assigned to a plot to tend and manage until harvest. According to their level of knowledge and skill, each family applied different techniques such as adding mulch, planting flowers, adding crop species, applying compost, releasing beneficial insects, etc. This diversity of management approach allows the testing of the effects of different farming methods on pest populations (i.e. monocultures vs. polycultures, the effects of flowering plants in the

garden, companion planting, etc.). It also allowed the various families to compare performance of the various plots and assess why certain plots work better than others in terms of pest regulation and crop health and productivity.

On August 4, another workshop was offered on EBPM, where students and their families were trained to use sticky traps, microscopes, direct counting, and collecting of various life stage forms of insects to quantify pest populations and associated natural enemies. Students also were shown how to identify parasitized vs. non-parasitized specimens. These was collected and analyzed to determine percent parasitism, mean populations, standard deviations, etc. Crop yields were also recorded and the results and conclusions were presented to the participating families and the wider community during a fall workshop. This workshop was designed to expose community members (including neighborhood residents, master gardeners, urban farmers, etc) to the findings of the community gardening project.

The resulting data collected are shown in Figures 1 and 2. The plots shown on these graphs were chosen as representatives of different degrees of plant diversity within these plots. Here is a table of the selected plots:

<b>Plot #</b>	<b>Plant diversity within each plot</b>
2	Medium-High
5	High
8	Medium-High
9	Medium
10	Low
14	No maintenance

When comparing the 6 plots we find that plot #5, which had the highest plant diversity, had also the best crop health according to our indicators. At the other extreme is plot #10, which had the lowest plant diversity, and had the worst crop health, especially in the Aug. 8 survey (Figure 2). These results correlate well with the theory that higher plant diversity is essential for crop health.

The feedback we received from the participating families was very enthusiastic. Both parents and children were very excited to grow their own food without the use of any toxic chemicals and to harvest an abundance of crops that were both nutritious and free of pesticides. In addition; after the end of the project we send a survey to all the members asking them to rate the project and tell us what was the impact of the project. We received 12 replies out of 20 participating families (Table 1).

- 1) In a scale of 1-10 (10 being the highest score) how would you rate the project overall?
- 2) What were your expectations of the project. Did the project meet these expectations?
- 3) Did you find the information presented during the workshops valuable?
- 4) Is there any other material you would have liked to have covered?
- 5) Did you like the format of the workshops?

- 6) Are you planning to continue gardening?
  - 7) Did the project contribute to making gardening more enjoyable?
  - 8) Would you consider starting a community garden in your neighborhood?
  - 9) Do you find that ecological gardening methods allowed you to produce good quality food?
  - 10) Do you think you can grow vegetables without using chemical pesticides and fertilizers?
  - 11) Please add any additional comments or suggestions.
- The responses are summarized in the following table:

Table 1.

Rate project overall (1-10)	8.8 points
<b>Question</b>	<b>YES (% responders)</b>
2) Project meet expectations?	100
3) Workshops valuable/	75
5) Liked workshop format?	75
6) Continue gardening?	100
7) Gardening more enjoyable?	100
8) Start community garden?	42
9) EBPM produces quality food?	100
10) Can you garden without chemicals?	92

- c. Involve students in all practical aspects of garden development and allow students to conduct comparative research in pilot areas of the gardens to test the effects of various agroecological practices on pest incidence.

In addition to the community garden plots, two research and demonstration plots were established to test the effects of fertilizer and crop diversity on biological pest control. The first experiment compared broccoli plants fertilized with a chemical fertilizer to broccoli plants fertilized with a composted horse manure. In early June students planted cabbage plants and amended them with either a chemical fertilizer or composted horse manure. The plants were drip irrigated and weeds were controlled through hand-weeding. The students monitored aphid populations by either direct counting of aphids on broccoli plants or with the use of yellow sticky traps. The direct counting of aphids showed a significantly higher initial colonization of broccoli plants by aphids in the plots amended with the chemical fertilizer as compared to the organic amended plots (Figure 3a). The difference observed during the first counting showed the plots amended with horse manure having a 55% reduction in aphid populations compared to the plots amended with the chemical fertilizer. Aphid populations became similar under both treatments during subsequent monitoring (Figure 3b, 4a and 4b). Similar results were obtained from the sticky trap monitoring (Figures 5a and 5b). It is important to note that yields of the broccoli plants were similar for plants under either treatment (Figure 6).

One hypothesis that was discussed with the students to explain such differences was that chemically fertilized plants, due to the higher concentration of available nitrogen in the soil, had a higher concentration of free nitrogen in the leaves, thus rendering chemically fertilized plants more attractive to aphids. The fact that aphid population levels were similar in both treatments later in the season, indicates that the concentration of the nitrogen in the soil from the chemical fertilizer was most probably reduced through plant uptake and leaching, reducing the concentration of free nitrogen in the leaves of the chemically fertilized plants.

The second was designed to test the effects of inter-cropping on the main crop. A 50m x 15m area at the Gill Tract was plowed to incorporate the winter cover crop and tilled to form long rows, 1 m on centers. At the end of May the field was divided into 5 smaller plots crosswise to the rows. In each plot cabbage was inter-cropped with one of the following: basil, lettuce, Swiss Chard, beans, or with no inter-crop. Sticky traps and direct counting were used to estimate the populations of pest and beneficial insects; results were analyzed to determine the effects of the different treatments on pest control. The initial colonization of cabbage plants by aphids was found to be 70% higher in the monoculture and the bean plot compared to the other 3 inter-crops (Figure 7). It is interesting to note that three of inter-crops, basil, lettuce and Swiss Chard, and cabbage were planted as seedlings, while the beans were planted as seeds. During the first few weeks before the bean seedlings appeared, the cabbage plot which was inter-cropped with beans appeared essentially as a mono-crop, which might explain why the bean inter-crop has such a high initial colonization, comparable to the mono-cropped cabbage plot.

d. To disseminate project achievements and results to other schools by bringing classes to the site, and to the wider community through outreach activities such as field days, workshops and cross-visits.

A summer fair and field day was held on July 7, where community members and students from surrounding schools were given workshops on ecologically-based pest management and tours of the research facilities and community gardens.

During the summer, groups of students from the "Environmental Leadership Outreach Program" of the College of Natural Resources, UC Berkeley, visited our research plots and were trained in basic agroecological principles. The training included hands-on planting and pest identification activities.

Another field day and seed saving workshop which was open to the wider community was held on October 13. There were over 20 participants who attended the entire event and an additional 10 who came to the afternoon session.

In the morning session we presented three slide shows on the following subjects:

- a. ecological gardening and the basic principles of biological control
- b. community gardening and its importance in strengthening communities and creating food security
- c. seed saving and its importance in maintaining genetic diversity

The afternoon session started with a seed saving workshop which included hands-on seed processing techniques. This was followed by a seed swap, featuring local varieties adapted to the Bay Area. We received help and sponsorship for the swap from Bay Area Seed Interchange Library (BASIL) and the Ecology Center, two well-known local resources for urban gardening.

We concluded the event with a tour of two nearby community gardens. The first was on-site at the Gill Tract, where a current UC Berkeley study involving 20 families maintains a large and diverse planting of vegetable crops. The second community garden is located at the University Village, a large student housing complex adjacent to the Gill Tract . Throughout the tours of both sites, participants were able to observe various methods of weed management and pest control, and their effects on crop production and overall garden/system health (inter-cropping vs. monoculture, conventional insecticide vs. biological control, plant health, soil conditions, numbers of beneficial vs. predatory insects). We followed this with a group discussion of current issues facing urban gardeners and concluded with further resources for seeds and alternative pest management practices.

The feedback from the participants was very positive and participants were excited to learn about ecological gardening methods and seed saving in their backyards and/or community gardens. Their enthusiasm leads us to anticipate that this workshop will have a very good impact at the local level. Both the slide shows and the demonstrations, as well as the garden tours, clearly demonstrated that seed saving is a key activity in developing foundations for sustainable urban agriculture. By giving participants the hands-on experience in simple techniques, we expect that they will incorporate seed saving into their own individual practices, as well as teach these practices to others. The participants will also extend the knowledge they received on the principles of sustainable agriculture to many members of the general community—their friends and neighbors, social/church groups, family members and school-based activities, as well as through contacts in other community gardens in which they might be active. Overall we judge the workshop to be a successful one and hope to repeat it in the future.

## **SUMMARY AND CONCLUSIONS**

Based on the activities and achievements presented above, it can be stated that our training, demonstration and outreach project on EBPM in urban agriculture has been successful in continuing the capacity-building activities in schools and surrounding communities through:

1. Implementation of garden activities and training modules at schools
2. Training of community members in ecological gardening and environmentally sound methods of pest control
3. Outreach activities to the rest of the community through field days at Gill Tract and established school gardens

Our project differs from other initiatives in the Bay Area promoting local sustainable agriculture through community gardens, in that it is based on scientific principles of agroecology and EBPM with efforts specifically targeted at public schools to train students in urban agriculture and environmentally sound methods of pest control. Through field days, direct involvement of students through internships in community gardens and participatory research, benefits are extended to the community. In this way urban gardeners exposed to such outreach efforts are becoming increasingly aware of EBPM principles which in turn we expect will result in a substantial decrease in the use of pesticides in urban agricultural areas, thus leading to overall enhanced environmental quality in our communities. In addition, the established community garden at Gill Tract was designed and managed by participating families using agroecological principles of diversification, recycling, composting, soil biology activation, etc., according to each family's level of skills and rationale. IPM effects will be emergent properties of such systems, but as it is expected, pest levels and yields will be different in each plot, providing the opportunity to assess why certain plots performed better than others. By providing students and their families with key principles of ecology and insect biology, they have learned that as they design diversified gardens with rich organic soils and a variety of crops, they enhance the "immunity" of the garden resulting from the synergisms and trophic interactions typical of complex systems. A key success of this project has been the realization by students and community members that the link between healthy soils and healthy plants is fundamental to EBPM.

**APPENDIX A**  
*Figures 1-7*

# Community Garden Plots Crop Health Indicator Charts

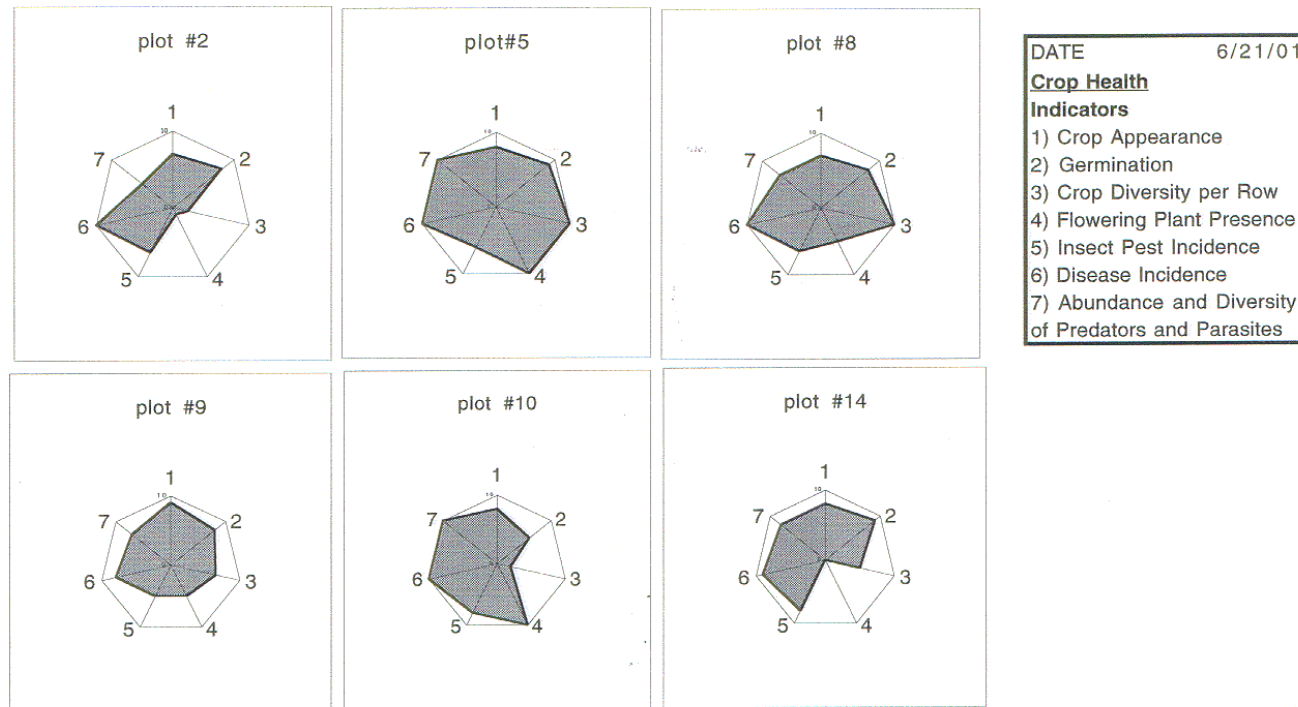


Figure 1

## Community Garden Plots Crop Health Indicator Charts

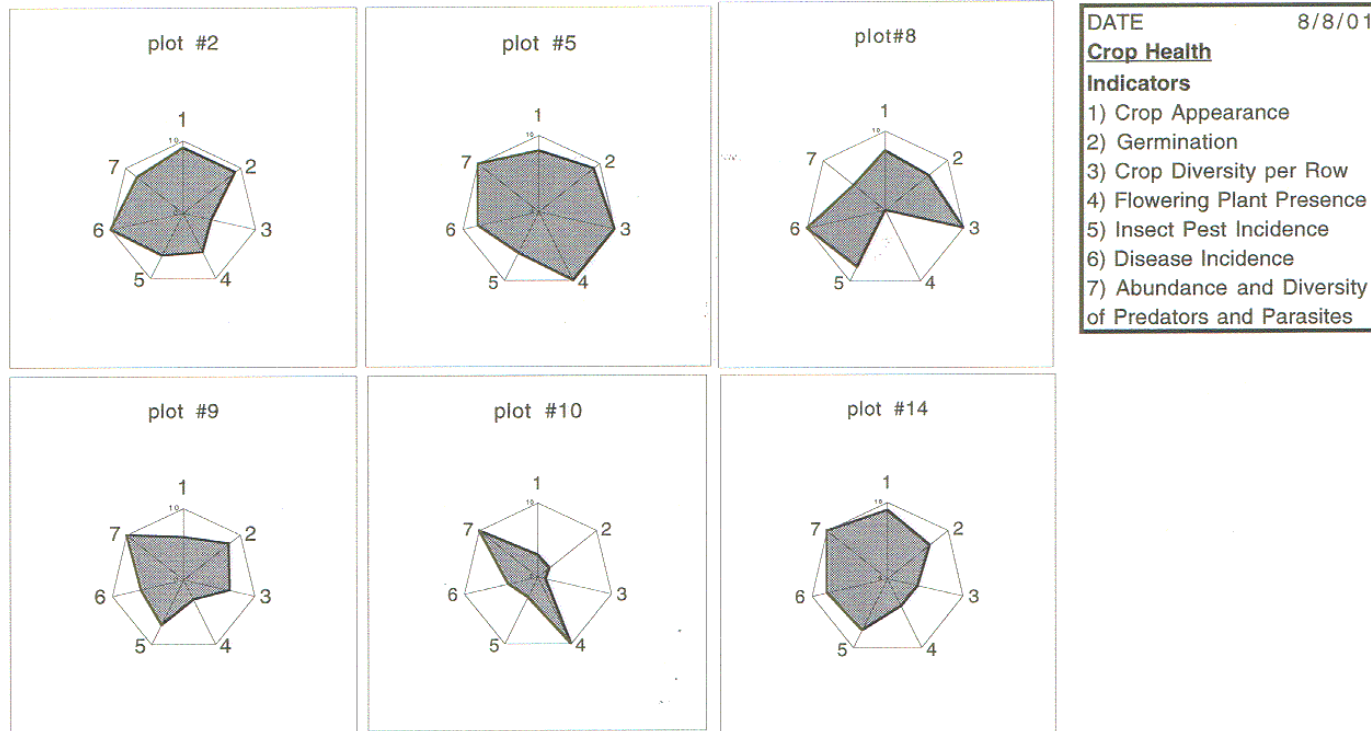


Figure 2

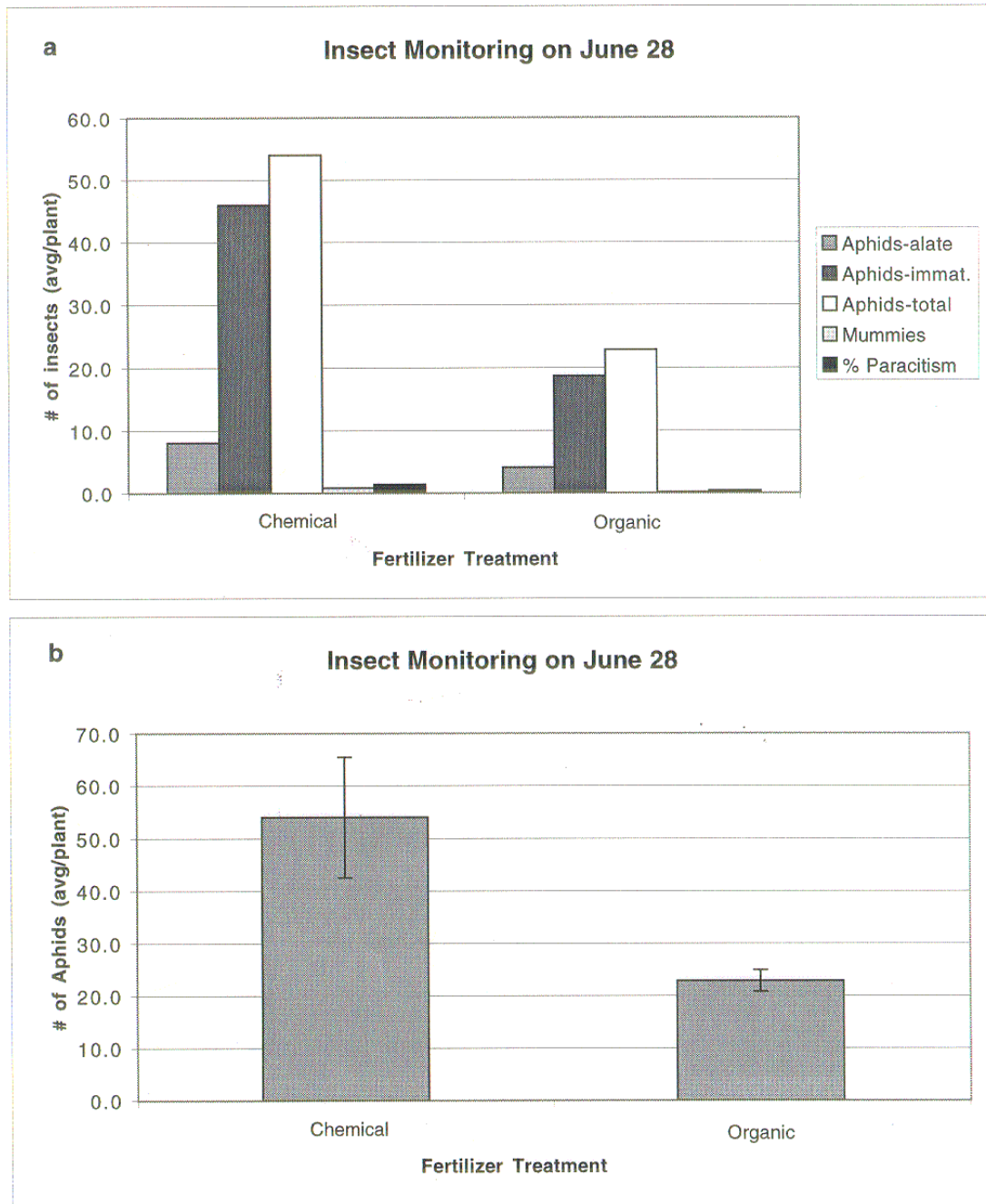


Figure 3

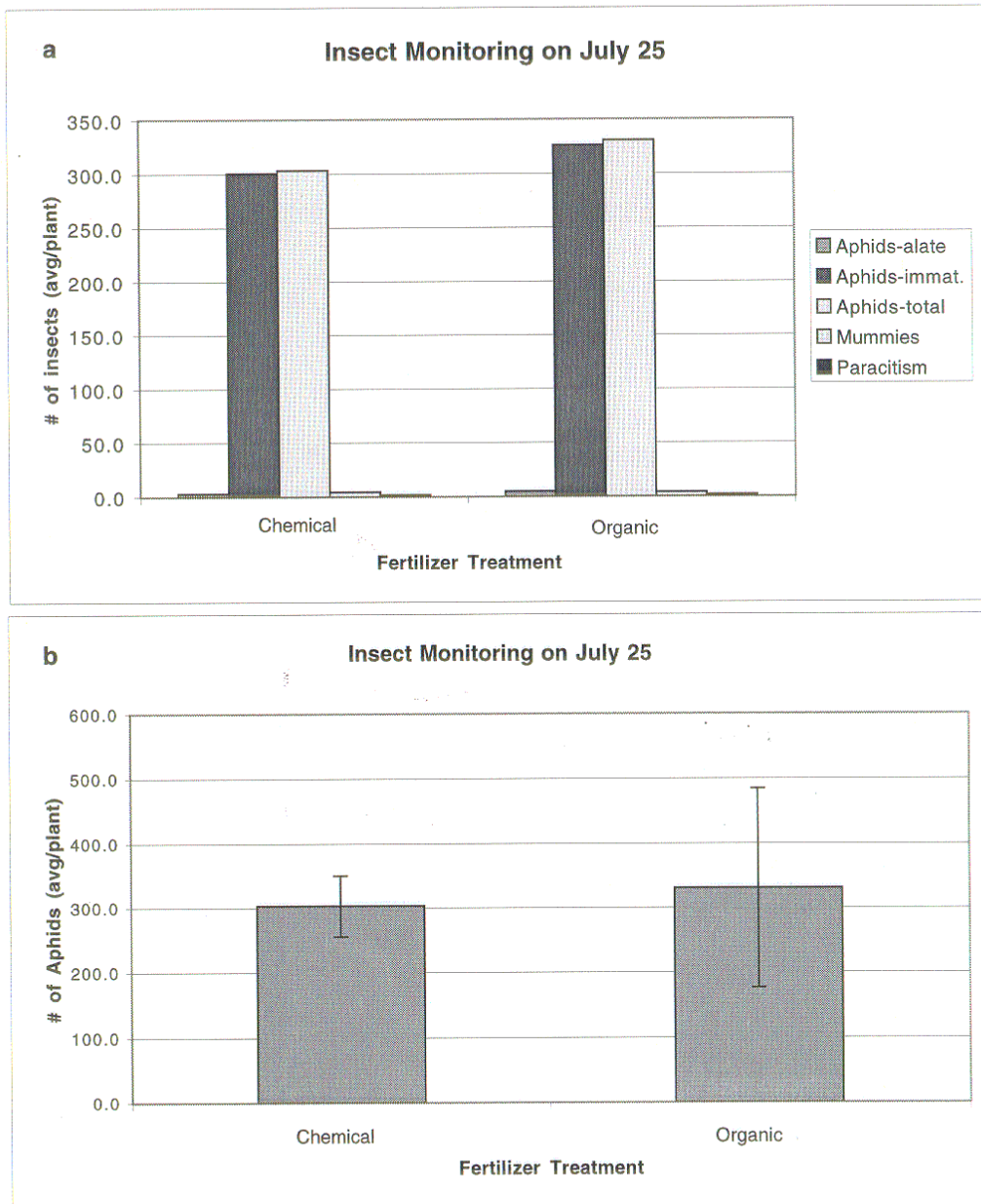


Figure 4

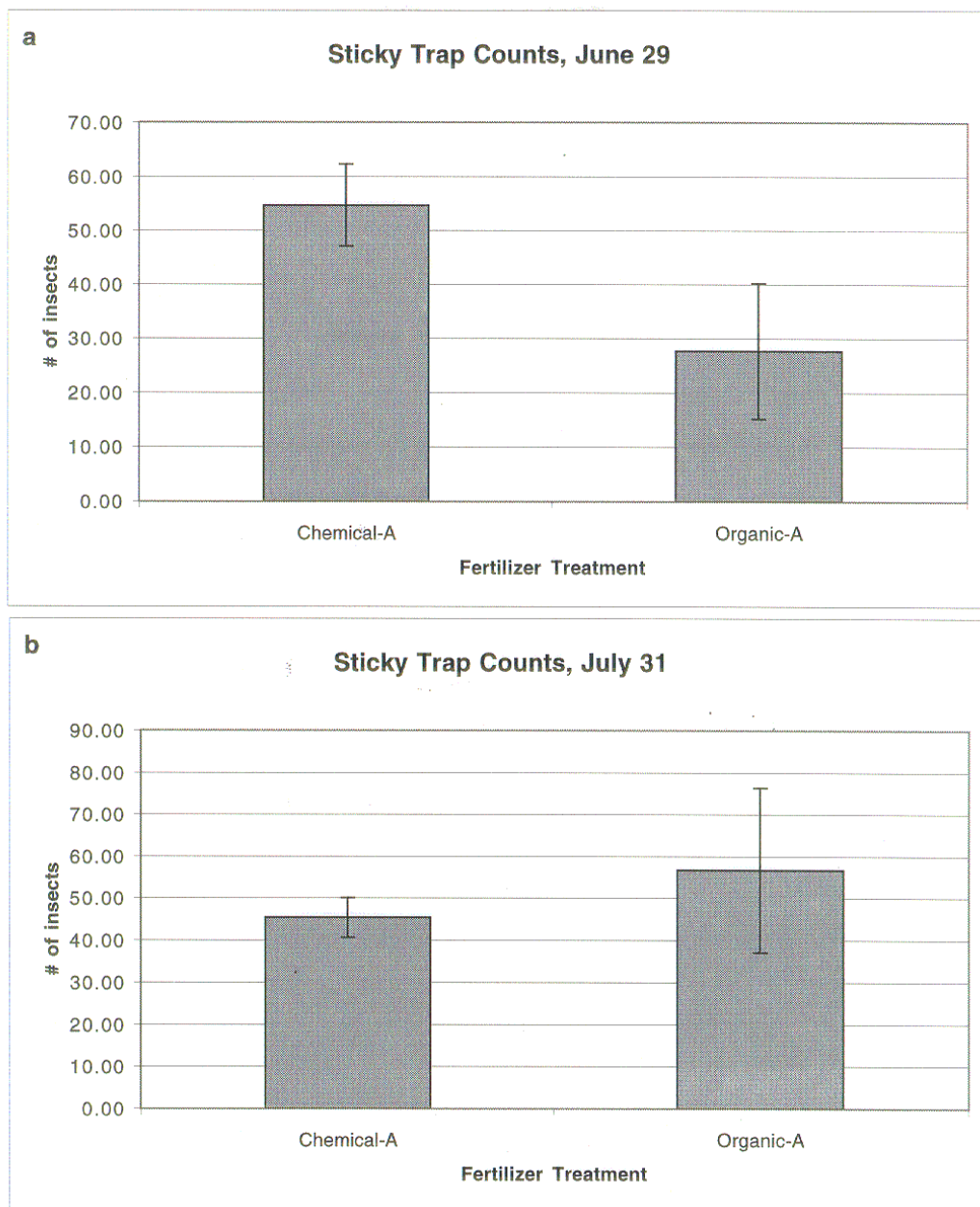


Figure 5

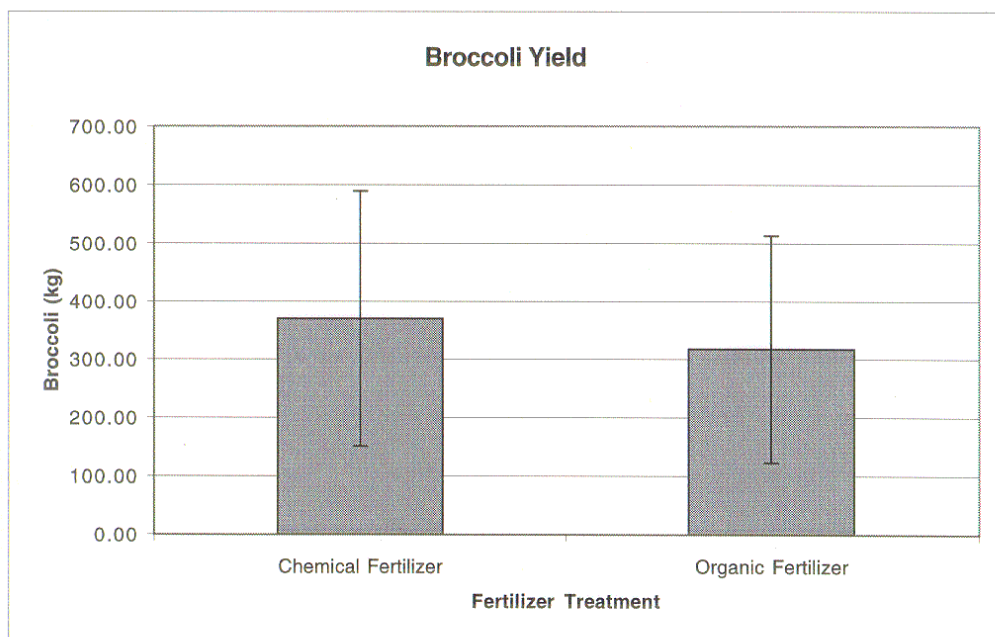


Figure 6

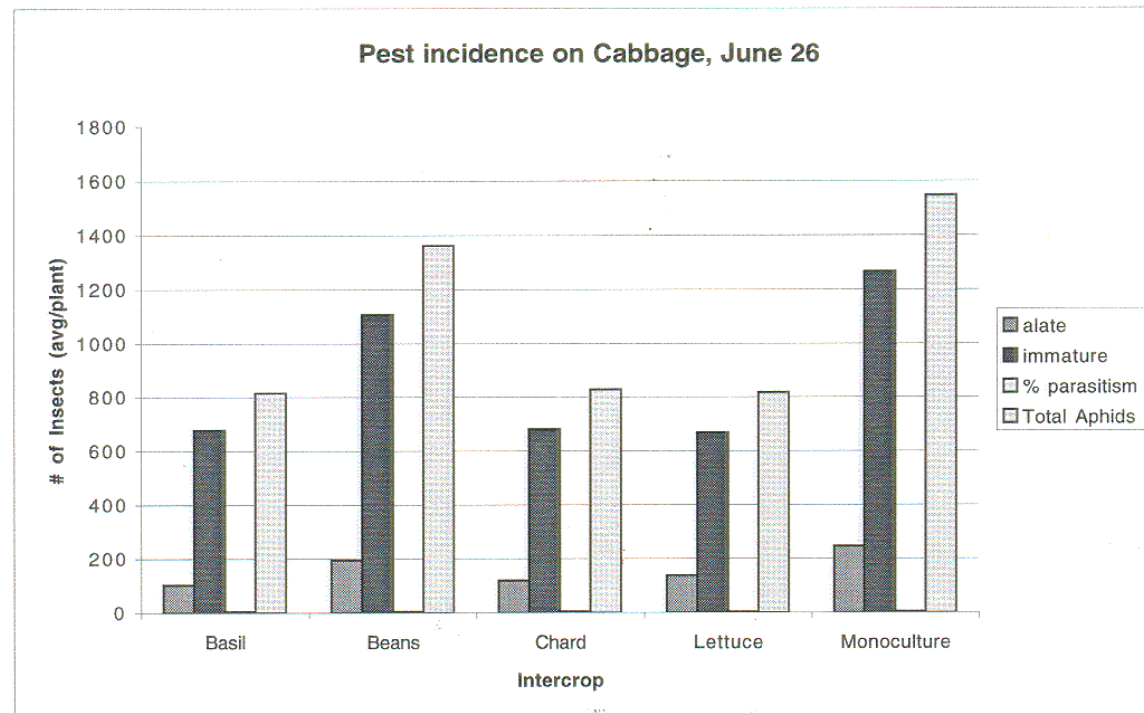


Figure 7

## **APPENDIX B**

Photos

Community Gardening Application Form

Community Gardening Project Flyer

Seed Saving Workshop Flyer

Reader on Ecological Horticulture

Community Gardening Project  
Gill Tract, UC Berkeley 2001



community planting day



planting with kids



Figure 10a. Gill Tract demonstration area.



Figure 10b. Community Garden construction.

Interested in Summer Gardening?

## We are looking for families to join our Community Gardening Project!

Come join us at the Gill Tract (Corner of Marin and San Pablo in Albany) where we are doing research into urban community gardens.bvb

We will provide preformed garden beds for you and your family. The soil will be all ready for planting.

We will also supply seeds and seedlings for tomatoes, basil, lettuce, beans, swiss chard, broccoli, cabbage, and carrots (you can plant lots of other stuff, too, if you like). We'll also provide compost and mulching material, and take care of watering the plots during the week.

In addition, we will provide training in ecological gardening methods through workshops and informal consultations.

Your commitment will be to spend a few hours each week tending the garden plots, weeding, mulching and harvesting.

*Application deadline April 17, 2001*

**For more information and details on how to apply please contact:**

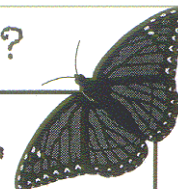
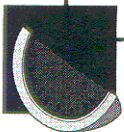
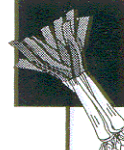
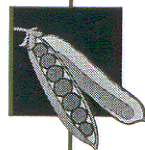
**Prof. Miguel Altieri**  
(510) 642-9802  
agroeco3@nature.berkeley.edu

— or —

**Dr. Christos Vasilikiotis**  
(510) 643-0541  
christos@nature.berkeley.edu

### Community Gardening Project Summer 2001

Contact:  
**Prof. Miguel Altieri**  
(510) 642-9802  
agroeco3@nature.berkeley.edu  
**Dr. Christos Vasilikiotis**  
(510) 643-0541  
christos@nature.berkeley.edu



# Summer Fair & Educational Day on Urban Agriculture

**Free! Fun! Informative!**  
**Community and Family Event**

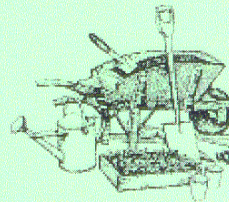
Saturday July 7<sup>th</sup> 2001

10am-2pm

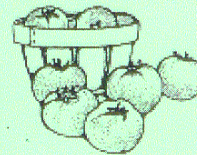
At the Gill Tract (rain or shine)

Marin and San Pablo Avenues in Albany

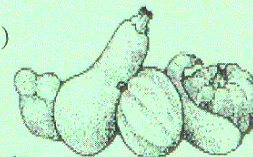
Music



Free Raffles



- Hands on activities & exhibits (kid friendly!)
- Presentations on sustainable practices
- Farm Fresh Organic Food to Sample
- Future of the Gill Tract Discussion
- Information about Genetically Modified Foods & Food Safety
- Video Screenings: The Greening of Cuba: Community Gardens:
- Beyond Organic: The Vision of Fairview Gardens



Contact: Shyaam M. Shabaka Chair. BACUA  
For Info: 510 654-4400

Bird Houses

*Partial Sponsor List:*

Bay Area Coalition For Urban Agriculture, Food First, Albany Coalition for Environmental Health, Agroecology Lab, College of Natural Resources, UC Berkeley

Come to a

# ***Community Gardening & Seed Saving Workshop***

**Saturday October 13,  
10am - 4pm**

Come join us for a hands-on workshop at the Gill Tract Experiment Station and learn about ecological farming, community gardening and seed saving.

***Slide shows and demonstrations on seed saving***

***Hands-on seed processing techniques***

***Fall harvest seed swap***

***Tour demonstration plots and neighboring community gardens***

Please bring a brown bag lunch.

Workshop will be taught by:

Christos Vasilikiotis, UC Berkeley, &  
Christopher Shein, BASIL & Wildheart Gardens.

Sponsored by:

BASIL (Bay Area Seed Interchange Library) & The Ecology Center

Funded by:

Sustainable Agriculture and Research Education Program (SAREP) &  
California Department of Pesticide Regulation (DPR)

The Gill Tract is part of the College of Natural Resources  
at the University of California at Berkeley.

It is located at the corner of Marin Avenue & San Pablo Avenue in Albany.

For more information, please contact:

Christos Vasilikiotis: [christos@nature.berkeley.edu](mailto:christos@nature.berkeley.edu)  
ph: (510) 643-0541

**APPLICATION**  
**Gill Tract Community Gardening Project**  
**Summer 2001**

**Name:**

**Address:**

**Phone & email:**

**Family members (please include ages for all children):**

**Tell us few things about yourself and why you want to participate:**

**How did you find out about our project?**

**Your Requirements and Responsibilities:**

- Enjoy gardening and eating fresh vegetables!
- Be able to commit to working at your plot 8 hours per week (you can combine the hours each family member is contributing) from May 15 to September 15 2001.
- Collect data, such as weighing the crops you harvest and taking simple measurements (Staff members will be available to help with data collection).
- Keep a log of all your activities in the farm (inputs, management practices).
- At least one family member should participate in each of the workshops that we will offer during the project.
- Be willing to experiment and try new approaches in gardening (trying different mulches, adding flowering plants or herbs in your plot, etc.)

**Our Commitment:**

- We will prepare the garden rows for your plots.
- Provide all seeds and seedlings for the main crops. You will only need to provide seeds for any other crops or herbs you might want to add to your plot.
- We will provide compost and some mulching materials, but you will have to provide any other materials you might want to use to enhance your plots.
- We will provide basic gardening tools.
- We will set up a drip irrigation system and water your plots.
- Provide two workshops on organic gardening. The workshops will cover general gardening skills, ecological pest management and soil fertility.
- Offer informal consultations during the duration of the project.

*Please respond by April 26<sup>th</sup>. E-mail to [christos@nature.berkeley.edu](mailto:christos@nature.berkeley.edu) or mail to  
Christos Vasilikiotis, ESPM, UC Berkeley, 201 Wellman #3112, Berkeley, CA 94720-3112*